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⑭発明の名称　スタンパの金型取付面の研磨方法およびその研磨機

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明　細　書

1．発明の名称

スタンパの金型取付面の研磨方法およびその研磨機

2．特許請求の範囲

1．研磨機を使用するスタンパの金型取付面の研磨方法において、

研磨前のスタンパの厚さから研磨により仕上げようとする所定のスタンパの厚さを減じて得た値を研磨代寸法としたのち、前記研磨を開始し、

研磨中、光学式変位計により前記スタンパの金型取付面の研磨量を常時測定してその測定値が前記研磨代寸法に達したときに前記研磨機を停止させることを特徴とするスタンパの金型取付面の研磨方法。

2．保護盤に装着しているスタンパの金型取付面と研磨定盤に張られた研磨クロスとを互いに摺接させる研磨機において、

前記金型取付面と平行に前記保護盤に形成された測定面と、

該測定面に測定光を照射する前記研磨定盤に設置された光学式変位計のセンサと、

該センサの測定信号に基づいて前記金型取付面に垂直な方向の前記測定面の変位量の測定値を常時演算して求める前記光学式変位計の演算部と、

ひとつの研磨代寸法を設定でき、かつ前記測定値が該研磨代寸法に達したときに前記研磨機を停止させる制御ユニットとを備えたことを特徴とするスタンパの金型取付面の研磨機。

3．発明の詳細な説明

[産業上の利用分野]

本発明は、各種の情報信号が記録されたコンパクトディスクや光ディスク等の情報記録盤の複製基板を成形するためのスタンパの研磨に関し、特に該スタンパをプレス用もしくは射出成形用の金型に取り付けるためのスタンパの金型取付面の研磨方法およびその研磨機に関するものである。

[従来の技術]

従来、スタンパの金型取付面と研磨クロスとを

互いに摺擦させる研磨機を使用したスタンパの金型取付面の研磨方法には、次のものがある。

まず、マイクロメータ、超音波厚さ計、渦電流厚さ計、光学式変位計等を用いて測定した研磨前のスタンパの厚さから研磨により仕上げようとする所定のスタンパの厚さを減じて研磨代寸法を求める。

該研磨代寸法と経験的に求めておいた研磨レート（単位時間当たりの研磨量、例えば1.0 μm／分など。）とから、誤差を見込んで研磨時間を計算して前記研磨機のタイマーに設定する。

該タイマーにより研磨機が自動停止するまで前記スタンパの金型取付面の研磨をする。

該研磨を終えたのち、スタンパを洗浄してその厚さを測定する。その測定値が前記所定のスタンパの厚さに達していれば研磨をそのまま終了し、そうでなければ前記研磨レートを修正して同じ工程を前記所定のスタンパの厚さに達するまで繰り返す。

〔発明が解決しようとする課題〕

上記従来の技術では、実際の研磨レートは、研磨クロスの目詰まり度、スタンパの金型取付面の面粗度、各部の温度等の諸条件により研磨のたびに変化するので、あらかじめ経験的に求めておいた研磨レートとは差異が生じてしまう。したがって、研磨時間の計算には誤差を見込む必要があり、研磨を終えるたびにスタンパの厚さの測定をしなければならないという問題点がある。また、スタンパの厚さの測定前には洗浄が必要であり、その洗浄時にあるいは測定時に傷をつけやすいという問題点もある。さらに、繰り返しの研磨、測定に多大の時間がかかるという問題点がある。

本発明は、上記従来の技術の問題点に鑑みてなされたものであり、研磨を終えるたびに、スタンパの洗浄とその厚さの測定とを繰り返す必要のない、研磨時間の短いスタンパの金型取付面の研磨方法およびその研磨機を提供することを目的とするものである。

〔課題を解決するための手段〕

上記目的を達成するため、本発明のスタンパの金型取付面の研磨方法は、

研磨機を使用するスタンパの金型取付面の研磨方法において、

研磨前のスタンパの厚さから研磨により仕上げようとする所定のスタンパの厚さを減じて得た値を研磨代寸法としたのち、前記研磨を開始し、

研磨中、光学式変位計により前記スタンパの金型取付面の研磨量を常時測定してその測定値が前記研磨代寸法に達したときに前記研磨機を停止させることを特徴とするものである。

本発明のスタンパの金型取付面の研磨機は、

保持盤に被着しているスタンパの金型取付面と研磨定盤に張られた研磨クロスとを互いに摺擦させる研磨機において、

前記金型取付面と平行に前記保持盤に形成された測定面と、

該測定面に測定光を照射する前記研磨定盤に設置された光学式変位計のセンサと、

該センサの測定信号に基づいて前記金型取付面に垂直な方向の前記測定面の変位量の測定値を常時演算して求める前記光学式変位計の演算部と、

ひとつの研磨代寸法を設定でき、かつ前記測定値が該研磨代寸法に達したときに前記研磨機を停止させる制御ユニットとを備えたことを特徴とするものである。

〔作用〕

上記のように構成された本発明のスタンパの金型取付面の研磨方法において、

研磨前のスタンパの厚さから研磨により仕上げようとする所定のスタンパの厚さを減じて得た値である研磨代寸法は、スタンパの金型取付面が研磨により削り取られるべき寸法である。したがって、研磨中、光学式変位計によりスタンパの金型取付面の研磨量が常時測定されてその測定値が前記研磨代寸法に達したときに、前記所定のスタンパの厚さが得られる。

また、本発明のスタンパの金型取付面の研磨機

において、

測定面は、スタンパが被　している保護盤に形成されているので、該スタンパの金型取付面に垂直な方向の該測定面の変位量は、該金型取付面の研磨量である。

したがって、光学式変位計は、前記研磨量を常時測定してその測定値を求めていることになる。

制御ユニットに前記研磨代寸法を設定して研磨を開始すると、該制御ユニットは前記測定値が前記研磨代寸法に達したときに研磨機を停止させるので、所定のスタンパの厚さが得られる。

【実施例】

本発明の実施例を図面に基づいて説明する。

まず、本発明の方法の実施に使用するスタンパの金型取付面の研磨機の第１実施例について説明する。

第１図および第２図において、スタンパ１は、情報信号をカッティングしたガラス原盤上にニッケルを500 ～2000Åの厚さに蒸着して導電化した後、その上に電鋳によりニッケルを305 ～330 μmの厚さに電着して形成したものであり、前記ガラス原盤そのものである円盤状の保護盤２に剥離されずにそのまま被着されている。また、該スタンパ１の金型取付面１ａは、研磨定盤６に張られた研磨クロス５に当接する。

前記研磨定盤６は、図示しない研磨機本　（以下、単に「本体」という。）に回転可能に設置されており、その軸部６ａは、電動モータ等から構成される本体に設けられた駆動部９の出力軸に接続され、設定された回転数で研磨定盤６を回転させる。

一方、本体に昇降かつ回転自在に被着された軸部７ａを有する円盤状の研磨ホルダ７は、図示しない移動機構により軸方向に移動自在であり、前記保護盤２のスタンパ１が被着している面と反対側の全面を前記研磨定盤６に対して設定された圧力で均一に押圧可能である。また、該研磨ホルダ７には図示しない吸盤が埋設されており、該吸盤により前記保護盤２を吸着することにより保持する。

また、該研磨ホルダ７は、前記研磨定盤６の回転中心軸とずれた位置にその回転中心軸があり、研磨定盤６が回転することにより、その回転とは反対回りの回転をする。これにより前記スタンパ１の金型取付面１ａと前記研磨クロス５とが互いに摺接して研磨される。該研磨に際しては、本体の研磨剤が設定された割合で前記研磨クロス５に滴下される。

測定面２ａは、前記保護盤２のスタンパ１が被着している面より外側の面に環状に形成されており、前記金型取付面１ａと平行で前記研磨クロス５に対向している。

ガラス板４は、前記研磨定盤６に張られた研磨クロス５の表面からわずかに後退しては同一平面を形成するように該研磨定盤６の適宜部位に形成された取付孔６ｂに嵌着されており、その表面は前記研磨クロス５が張られることなく露出している。

光学式変位計（例えば、株式　社キーエンス製の光学式変位センサＰＡシリーズ。）３のセンサ３ａは、前記取付孔６ｂの前記ガラス板４より下方に嵌着されており、その測定光３ｄは、該ガラス板４を透過して前記測定面２ａを照射可能である。

前記測定光３ｄは、研磨定盤６の回転に伴って移動し、１回転する間に前記測定面２ａと２回交差するので、その交差のたびに該測定面２ａを照射することになる。

前記センサ３ａはコード３ｃおよび不図示のスリップリング等を介して前記光学式変位計３の演算部３ｂに接続されている。

該演算部３ｂは、前記センサ３ａの測定信号に基づいて前記金型取付面１ａに垂直な方向の前記測定面２ａの変位量の測定値を常時演算して求め、制御ユニット８に入力するものである。

本体に設けられた該制御ユニット８は、ひとつの研磨代寸法を設定でき、かつ前記測定値が該研磨代寸法に達したときに前記駆動部９を停止させて研磨を終了させる機能を有する公知のもので

る。

つぎに、本実施例を用いたスタンパの金型取付面　研磨方法　実施例について説明する。

まず、研磨前　スタンパ1の厚さから研磨により仕上げようとする所定のスタンパの厚さ、例えば295 μm を減じて得た値を研磨代寸法として制御ユニット8に設定する。

つぎに、研磨ホルダ7に、保護盤2のスタンパ1が被着している面と反対側の全面を当接させて該保護盤2を吸着により保持させ、酸化アルミニウム研磨剤（例えば、商品名ポリプラ700.）を毎分50mlの割合で研磨クロス5に滴下させ始める。その後、前述した移動機構を操作して前記研磨ホルダ7を移動させ、スタンパ1の金型取付面1aを前記研磨クロス5に圧力100g/cm²で押圧させ、光学式変位計3のセンサ3aの測定光3dの焦点調整を行なう。その状態で研磨定盤6を駆動部9により回転数60rpm で回転させ研磨を開始する。

研磨中、光学式変位計3の演算部3bは、前記センサ3aの測定信号に基づいて、金型取付面1aに垂直な方向　測定面2a　変位量の測定値を常時演算して求　、前記制御ユニット8に入力する。該制御ユニット8は、前記測定値が前記研磨代寸法に達したときに前記駆動部9を停止させ研磨を終了させる。

また、ガラス原盤に被着している研磨前のスタンパの厚さを超音波厚さ計により測定してその厚さが320 μm であったものを、上記方法に従って、研磨代寸法を25μm と設定して研磨をしたところ、研磨開始から終了までに要した時間は28分間であった。また、研磨後のスタンパの厚さを前記超音波厚さ計で数個所測定してみたところ、294 ～296 μm の値が得られた。

なお、前記所定のスタンパの厚さは295 μm に限る必要はなく、また、前記研磨剤の滴下割合、研磨ホルダ7の圧力および研磨定盤6の回転数は、上記以外の適宜値にそれぞれ設定可能である。

本発明の研磨機の第2実施例について説明する。

上記第1実施例では電鋳に用いたガラス原盤をそのまま保護盤2として使用する例を示したが、本実施例では第3図に示すように、ガラス原盤と同様の大きさの円盤状のガラス板を保護盤22として使用している。電鋳後、スタンパ21をガラス原盤から剥離し、その内径および外径を所定の寸法に切断し、ついで該スタンパ21の情報信号面21bに接着剤22bを塗布し、該スタンパ21を該接着剤22bを介して前記保護盤22に被着させている。その他の点は第1実施例と同様である。

また、保護盤に接着剤を介して被着している研磨前のスタンパの厚さを超音波厚さ計により測定してその厚さが318 μm であったものを、研磨代寸法を23μm として設定し、さらに研磨剤の滴下割合、研磨ホルダ7の圧力および研磨定盤6の回転数の値をそれぞれ第1実施例と同一に設定して研磨をしたところ、研磨開始から終了までに要した時間は22分間であった。研磨後のスタンパの厚さを前記超音波厚さ計で数個所測定してみたところ、293 ～297 μm の値が得られた。

つぎに、本発明の第1および第2実施例と比較するために行なった、従来の技術の欄で説明した方法によるスタンパの金型取付面の研磨の一例について説明する。

まず、電鋳後のスタンパの厚さを超音波厚さ計で測定したところ315 μm であった。研磨により仕上げようとする目標値を295 μm と設定し、研磨機の研磨レートを実績値から1.0 μm ／分とし、過剰研磨しないよう考慮して研磨時間を計算して15分間とした。該研磨時間を研磨機のタイマーに設定し、また、研磨ホルダの圧力、酸化アルミニウム研磨剤の滴下割合および研磨定盤の回転数を第1および第2実施例と同一に設定して研磨を開始した。前記タイマーにより研磨機が停止した後、スタンパを洗浄してその厚さを前記超音波厚さ計で測定したところ、305 μm であった。

ついで、前記研磨レートを0.7 μm ／分に修正

し、あらたに研磨　間を１５分として研磨機のタイマーに設定し、再び同様に研磨を開始した。研磨機が停止したのち、スタンパを洗浄してその厚さを前記超音波厚さ計で測定したところ、291 μm であった。

研磨開始から終了までに要した時間は、全体で５０分であり、研磨終了時のスタンパの厚さは前記目標値より４μm 薄く仕上がった。

以下に本発明の各実施例と従来の技術の欄で説明した方法とを比較した結果について説明する。

本発明の第１実施例に示したスタンパの厚さの仕上寸法は、294 ～296 μm であり、また第２実施例のそれは、293 ～297 μm であり、従来の方法に比較して仕上寸法精度が高い。また、研磨開始から終了までに要する時間も、第１実施例では２８分間、第２実施例では２２分間であり、従来の方法に比較して非常に短い。

なお、第１および第２実施例では、スタンパの代りにガラス板やシリコンウエハー等を研磨することも可能であり、同様の仕上寸法精度が確保できる。

［発明の効果］

本発明は、以上説明したとおり構成されているので、以下に記載するような効果を奏する。

光学式変位計は、研磨を中断せずに研磨中のスタンパの金型取付面の研磨量を常時測定することができる。

これにより、従来の如く経験的に求める研磨レートを採用した研磨と該研磨後のスタンパの厚さの測定とを繰り返し行なう必要がなくなるので、研磨開始から終了までに要する時間が大幅に短縮できる。

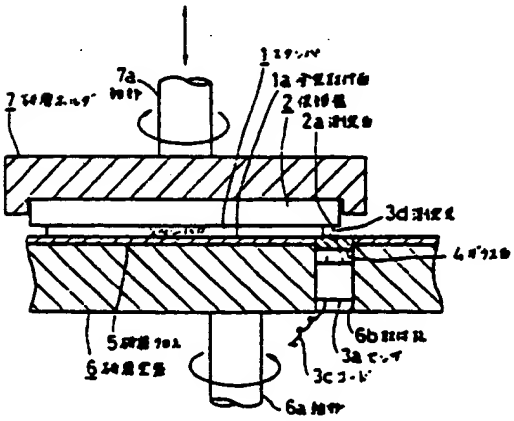
また、前記測定が不必要となるので洗浄時あるいは測定時にスタンパに傷が付くことがなくなる。

さらに、不確定な前記研磨レートではなく測定分解能の高い光学式変位計を使用するので、スタンパの厚さの仕上寸法精度を高めることができ、過剰研磨によるスタンパの不良発生も防止できる。

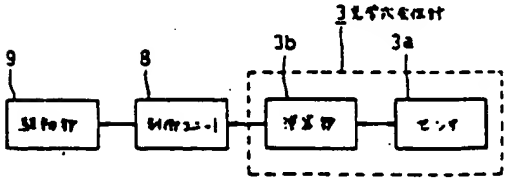
４．図面の簡単な説明

第１図は本発明の第１実施例の要部断面図、第２図は本発明の第１および第２実施例の構成を説明するためのブロック図、第３図は本発明の第２実施例の要部断面図である。

１，２１－スタンパ、
１ａ，２１ａ－金型取付面、
２，２２－保護膜、　３－光学式変位計、
３ａ－センサ、　３ｂ－演算部、
３ｃ－コード、　４－ガラス板、
５－研磨クロス、　６－研磨定盤、
６ｂ－取付孔、　７－研磨ホルダ、
８－制御ユニット、　９－駆動部。



第 1 図



第 2 図

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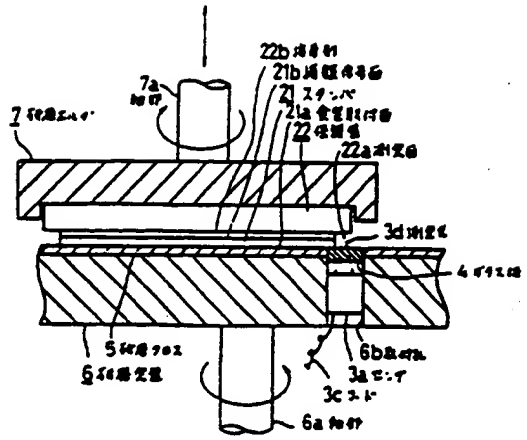

第 3 図

Kokai 3-234467(Attachment 1)
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Applicant : Canon
Title : A Polishing Method of a Die Attaching Surface of a Stamper and its Polishing Device

Abstract :

(translation from upper right-column, line 7 to lower right-column, line 16, page 3)

The polishing platen 6 is rotatably positioned on a polishing unit which is not shown. An axis 6a is connected to an output terminal of a driver 9 provided on the polishing unit which comprises an electric motor 9, etc. to rotate the polishing plate 6 at a predetermined number of revolutions.

A disk-shaped polishing holder 7 with an axis 7a is detachably and rotatably attached to an unit and moves freely in the axis direction by a moving mechanism. The polishing holder 7 can apply predetermined pressure uniformly on a surface of the holding plate 2 which is on the opposite side to a surface where a stamper 1 is attached. A suction cup which is not shown is provided in the polishing holder 7 to hold the holding plate 2 by adsorption.

The rotation axis of the polishing holder 7 is displaced from the rotation axis of the polishing platen 6. When the polishing platen 6 rotates, the polishing holder 7 rotates in a opposite direction. Thus, a die attaching surface 1a of the stamper 1 and the polishing cloth 5 on the polishing platen 6 are ground to each other. When polishing, liquid slurry is dropped on the polishing cloth 5 in a predetermined proportion.

A surface 2a to be measured is formed in a ring shape around the outside of a portion of the surface of the holding plate 2 where the stamper 1 is attached. The surface 2a to be measured is parallel with the die attaching surface 1a and is opposed to the polishing cloth 5.

A window glass 4 is inserted into an attachment hole 6b which is formed at an appropriate portion of the polishing platen 6 such that the window glass 4 is slightly behind the surface of the polishing cloth 5 affixed to the polishing platen 6 to form almost the same plane. The surface of the window glass 4 is not covered with the polishing cloth 5 and is exposured.

A sensor 3a of an optical displacement measuring device 3 is inserted into the attachment hole 6b below the window glass 4. Measurement light 3d passes through the window glass 4 and irradiates the surface 2a to be measured.

The measurement light 3d moves as the polishing plate 6 rotates, and crosses the surface 2a to be measured twice in a rotation. The measurement light 3d irradiates the surface 2a to be measured every time the light 3d crosses the surface 2a.

The sensor 3a is connected to a calculation element 3b in the optical displacement measurement device 3 via a slip ring or others which is not shown.

Based on the measured signal from the sensor 3a, the calculation element 3b calculates a measured value of a displacement of the surface 2a in a direction orthogonal to the die attaching surface 1a. The calculated values are input to a control unit 8.

The control unit 8 are known in the art which is allowed to set a polishing dimension and to stop the driving portion 9 when the measured value reaches the polishing dimension. (Fig. 1 and Fig. 2)

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POLISHING METHOD FOR DIE-INSTALLATION SURFACE OF STAMPER AND ITS POLISHING DEVICE THEREOF

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[There are no amendments to this patent.]

Claims

1. A polishing method for die-installation surface of stamper characterized by the following fact, that it makes use of a polishing device to polish the die-installation surface of the stamper, wherein, the targeted grinding dimensions are derived by subtracting the prescribed thickness of the stamper after polish finishing from the thickness of the stamper before polishing; then, the aforementioned polishing is started; during the polishing process, the polishing quantity on the die-installation surface of the aforementioned stamper is measured constantly by an optical displacement gauge; when the measured polishing quantity reaches the aforementioned targeted grinding dimension, the aforementioned polishing device is stopped.

2. A polishing device for a die-installation surface of a stamper characterized by the fact that the polishing device makes the die-installation surface of a stamper with an adhered protective disk rub against a polishing cloth placed on a polishing surface plate, and that the polishing device comprises the following parts: a measuring plane formed on the aforementioned protective disk parallel to the aforementioned die-installation surface; a sensor of an optical displacement gauge set in the aforementioned polishing surface plate to shine measuring light onto the aforementioned measuring plane; a computing element of the aforementioned optical displacement gauge which constantly computes

the measured value of the displacement of the aforementioned measuring plane in the direction perpendicular to the aforementioned die-installation surface based on the measurement signal of the aforementioned sensor; and a control unit which can set one targeted grinding dimension and can stop the aforementioned polishing device when the aforementioned measurement value reaches the targeted grinding dimension.

Detailed explanation of the invention

Industrial application field

The present invention pertains to polishing of a stamper used for molding duplicated substrates of information-recording disks, such as compact disks and optical disks, on which various types of information signals are recorded. More specifically, the present invention pertains to a polishing method and a polishing device used for the die-installation surface of the stamper mounted on a die for press molding or injection molding.

Prior art

A conventional method for polishing the die-installation surface of a stamper by using a polishing device which makes the die-installation surface of the stamper rub against a polishing cloth that will be described in the following.

First, the targeted grinding dimensions are derived by subtracting the prescribed thickness of the stamper after polish finishing from the thickness of the stamper measured with a

micrometer, an ultrasonic thickness gauge, an eddy-current thickness gauge, or an optical displacement gauge before polishing.

The polishing time is calculated from the targeted grinding dimensions and the polishing rate (polishing quantity per unit time, such as [illegible] um/min), which is derived from experience in consideration of the error. Then, the calculated polishing time is set in the timer of the aforementioned polishing device.

The die-installation surface of the aforementioned stamper is polished until the polishing device is stopped automatically by the aforementioned timer.

Once polishing is completed, the stamper is washed and its thickness measured. If the measured value reaches the prescribed thickness of the stamper, no further polishing is performed. Otherwise, the aforementioned polishing rate is rectified, and the same process is repeated until the measured value reaches the prescribed thickness of the stamper.

Problems to be solved by the invention

In the aforementioned conventional technology, the actual polishing rate changes with every polishing cycle depending on the amount of clogging of the polishing cloth, the roughness of the die-installation surface of the stamper, the temperatures of the various parts, and other conditions. As a result, the actual polishing rate is different from the polishing rate previously derived from experience. Consequently, it is necessary to estimate the error in calculating the polishing time. The thickness of the stamper must be measured after each polishing cycle. This is a disadvantage. Also, it is necessary to wash the stamper before measuring its thickness. The stamper is easy to damage during

washing or measurement. This is also a problem. In addition it takes a lot of time to polish the stamper and measure the thickness repeatedly. This is another problem.

The purpose of the present invention is to solve the aforementioned problems of the conventional method by providing a polishing method and a polishing device which can be used to polish the die-installation surface of the stamper in a short period of time without washing the stamper or measuring the thickness repeatedly after each polishing cycle.

Means to solve the problems

In order to realize the aforementioned purpose, the present invention provides a polishing method for die-installation surface of a stamper characterized by the fact that it makes use of a polishing device to polish the die-installation surface of the stamper, wherein the targeted grinding dimensions are derived by subtracting the prescribed thickness of the stamper after polish finishing from the thickness of the stamper before polishing; then, the aforementioned polishing is started; during the polishing process, the polishing quantity on the die-installation surface of the aforementioned stamper is measured constantly by an optical displacement gauge; when the measured polishing quantity reaches the aforementioned targeted grinding dimension, the aforementioned polishing device is stopped.

The present invention also provides a polishing device for a die-installation surface of a stamper characterized by the fact that the polishing device makes the die-installation surface of a stamper with adhered protective disk rub a polishing cloth placed on a polishing surface plate; and that the polishing device

comprises the following parts: a measuring plane formed on the foremention protective disk parallel to the aforementioned die-installation surface; a sensor of an optical displacement gauge set in the aforementioned polishing surface plate to shine measuring light onto the aforementioned measuring plane; a computing element of the aforementioned optical displacement gauge which constantly computes the measured value of the displacement of the aforementioned measuring plane in the direction perpendicular to the aforementioned die-installation surface based on the measurement signal of the aforementioned sensor; and a control unit which can set an targeted grinding dimension and can stop the aforementioned polishing device when the aforementioned measurement value reaches the targeted grinding dimension.

Function

In the aforementioned method of the present invention for polishing the die-installation surface of the stamper, the targeted grinding dimensions, which are calculated by subtracting the prescribed thickness of the stamper after polish finishing from the thickness of the stamper before polishing, are the dimensions of the die-installation surface of the stamper which should be worn off by means of polishing. Consequently, the polishing quantity of the die-installation surface of the stamper is constantly measured by an optical displacement gauge during the polishing process. When the measured value reaches the aforementioned targeted grinding dimensions, the aforementioned prescribed thickness of the stamper is realized.

Also, in the polishing device of the present invention for polishing the die-installation surface of the stamper, because th

measuring plane is formed on the protective disk to which the stamper is adhered. the displacement of the measuring plane in the direction perpendicular to the die-installation surface of the stamper is the polishing quantity of the die-installation surface.

Consequently, the optical displacement gauge constantly measures the aforementioned polishing quantity to derive the measured value.

The aforementioned targeted grinding dimensions are set in the control unit. After polishing is started, the control unit can stop the polishing device when the aforementioned measured value reaches the targeted grinding dimensions. In this way, the prescribed thickness of the stamper can be realized.

Application examples

In the following, application examples of the present invention will be explained with reference to figures.

The first application example of the polishing device used for embodying the polishing method of the present invention will be explained first.

Stamper (1) shown in Figures 1 and 2 is formed as follows: 500-2000 Å of nickel is deposited on a feed glass disk where cutting of information signals is performed; after voltage is applied, 305-330 μm of nickel is further electrodeposited on the disk by means of electroforming. In this case, the stamper is directly adhered to protective disk (2), which is the aforementioned feed glass disk, without being peeled off. Die-installation surface (1-a) of said stamper (1) is in contact with polishing cloth (5) laid on polishing surface plate (6).

Said polishing surface plate (6) is set in a rotatable manner on the polishing device body (referred to simply as "body" hereinafter) which is not shown in the figure. Its shaft ( ) is connected to the output shaft of driving part (9) which is arranged in the body and comprises an electric motor. Polishing surface plate (6) is rotated at a prescribed rate of rotation.

On the other hand, disk-shaped polishing holder (7) having shaft (7a), which is installed on the body in a freely detachable and rotatable manner, can move freely in the axial direction with the aid of a moving mechanism which is not shown in the figure. Under a pressure set with respect to said polishing surface plate (6), the polishing holder can uniformly press the surface of said protective disk (2) to which stamper (1) is adhered, as well as the entire surface on the opposite side. Also, an electrostatic attracting disk not shown in the figure is embedded in said polishing holder (7). Said protective disk (2) is attracted and held by this electrostatic attracting disk.

The central axis of rotation of said polishing holder (7) deviates from that of said polishing surface plate (6). As polishing surface plate (6) rotates, the polishing holder can rotate in the reverse direction. In this way, die-installation surface (1a) of stamper (1) and said polishing cloth (5) are rubbed against each other to perform polishing. During the polishing process, a liquid abrasive is added dropwise at a prescribed rate onto said polishing cloth (5).

An annular measuring plane (2a) is formed from the surface of said protective disk (2), to which stamper (1) is adhered, to the surface on the other side. The measuring plane is parallel to said die-installation surface (1a) and opposite said polishing cloth (5).

Glass plate (4) is placed in installation hole (6b) formed in an appropriate location of polishing surface plate (6) such that the glass plate is recessed slightly from the surface of polishing cloth (5) placed on said polishing surface plate (6) and is almost in the same plane. The surface of the glass plate is exposed without polishing cloth (5).

Sensor (3a) of optical displacement gauge (3) (such as optical displacement sensor PA series produced by Kiensu K.K.) is placed below said glass plate (4) in said installation hole (6b). Its measuring light (3d) can pass through glass plate (4) and shine on said measuring plane (2a).

Said measuring light (3d) moves as polishing surface plate (6) rotates. The measuring light intersects measuring plane (2) twice during one rotation. The measuring light shines on measuring plane (2a) at each intersection.

Said sensor (3a) is connected to computing element (3b) of optical displacement gauge (3) through cord (3c) and a slip ring which is not shown in the figure.

Said computing element (3b) constantly computes the measured value of the displacement of measuring plane (2a) in the direction perpendicular to the installation surface (1a) based on the measurement signal of said sensor (3a). The computing element then inputs the computation result to control unit (8).

Said control unit (8) set in the body is a conventional control unit which can set one targeted grinding dimension and can stop driving part (3) to finish the polishing operation when the aforementioned measured value reaches the targeted grinding dimension.

In the following, an application example of the method disclosed in the present invention for polishing the die-installation surface of the stamper will be explained.

First, the value calculated by subtracting the prescribed thickness of the stamper after polish finishing, e.g., 295 μm from the thickness of the stamper before polishing is set as the targeted grinding dimension in control unit (8).

Subsequently, the surface of protective disk (2), to which stamper (1) is adhered, and the entire surface on the opposite side are brought into contact with polishing holder (7). Said protective disk (2) is attracted and held by the polishing holder. Aluminum oxide abrasive (product name: Polybura 700 [transliteration]) is dropped on polishing cloth (5) at a rate of 50 mL/min. Then, the aforementioned moving mechanism is operated to move polishing holder (7) to press die-installation surface (1a) of stamper (1) against said polishing cloth (5) under a pressure of 100 g/cm². Also, measuring light (3d) of sensor (3a) of optical displacement gauge (3) is focused. In this state, polishing surface plate (6) is rotated by driving part (9) at a rate of rotation of 60 rpm to start polishing.

During the polishing process, computing element (3b) of optical displacement gauge (3) constantly computes the measured value of the displacement of measuring plane (2a) in the direction perpendicular to die-installation surface (1a) based on the measured signal of sensor (3a). The computing element inputs the computation result to said control unit (8). Control unit (8) stops said driving part (9) to finish the polishing operation when the measured value reaches the targeted grinding dimension.

If the stamper adhered to the feed glass disk has a thickness of 320 μm as measured by an ultrasonic thickness gauge before

polishing, and if polishing is performed according to the aforementioned method with the targeted grinding dimension set at 25 μm, it will take 28 min to finish the entire polishing process. Also, data in the range of 294-296 μm are obtained when the thickness of the stamper after polishing is measured by the aforementioned ultrasonic thickness gauge at several places.

There is no need to limit the aforementioned prescribed thickness of the stamper to 295 μm. Also, the dropping rate of the aforementioned abrasive, the pressure of polishing holder (7), and the rate of rotation of polishing surface plate (6) can be set at other appropriate levels.

In the following, a second application example of the polishing device disclosed of in the present invention will be explained.

In the aforementioned first application example, the feed glass disk for electroforming is used directly as protective disk (2). In this application example, however, as shown in Figure 3, a disk-shaped glass plate as large as the feed glass disk is used as protective disk (22). After electroforming, stamper (21) is peeled off the feed glass disk. The stamper is cut appropriately to meet the requirements on its minor diameter and major diameter. Then, adhesive (22b) is coated on information-signal surface (21b) of stamper (21). Stamper (21) is adhered to said protective disk (22) through adhesive (22b). The rest of this application example is the same as that of the first application example.

If the stamper which is adhered to the protective disk with the adhesive has a thickness of 318 μm as measured by an ultrasonic thickness gauge before polishing, if the targeted grinding dimension is set to 23 μm, and if the dropping rate of the abrasive, the pressure of polishing holder (7), and the rate of

rotation of polishing surface plate (6) are the same as in the first application example, it will take 22 min to finish the entire polishing process. Also, data in the range of 293-297 μm are obtained when the thickness of the stamper after polishing is measured by the aforementioned ultrasonic thickness gauge at several places.

In the following, an example of using the aforementioned conventional method to polish the die-installation surface of the stamper will be explained for comparison with the first and second application examples of the present invention.

First, the thickness of the stamper after electroforming is measured by an ultrasonic thickness gauge and turns out to be 315 μm. The targeted thickness after polish finishing is set to 295 μm. The polishing rate of the polishing device is derived as 1.0 μm/min from the actual results. The calculated polishing time turns out to be 15 min in consideration of the fact that no excessive polishing should take place. This polishing time is set in the timer of the polishing device. The pressure of the polishing holder, the dropping rate of the aluminum oxide abrasive, and the rate of rotation of the polishing surface plate are set to the same values as in the first and second application examples. Then, polishing is started. After the polishing device is stopped by the aforementioned timer, the stamper is washed, and its thickness is measured by the aforementioned ultrasonic thickness gauge. The measurement result is 305 μm.

Subsequently, the aforementioned polishing rate is rectified to 0.7 μm/min, and the polishing time is reset to 15 min in the timer of the polishing device. The polishing operation is started again in the same way. After the polishing device stops, the stamper is washed, and its thickness is measured with the

aforementioned ultrasonic thickness gauge. The measurement result is 291 μm.

It takes 50 min to carry out the entire polishing process. When the polishing operation is finished, the thickness of the stamper is 4 μm smaller than the targeted thickness.

In the following, the results of comparing the conventional method with the application examples of the present invention will be discussed.

The finished thickness of the stamper in the first application example of the present invention is in the range of 294-296 μm, and the finished thickness of the stamper in the second application example is in the range of 293-297 μm. The accuracy of the finished thickness in the application examples of the present invention is higher than in the conventional method. Also, as far as the time needed for the polishing process is concerned, the polishing operation takes 28 min in the first application example and 32 min in the second application example, which are significantly shorter than in the conventional method.

In the first and second application examples, instead of the stamper, a glass plate or a silicon wafer can also be polished, and the same accuracy of the finished thickness can be guaranteed.

Effects of the present invention

Depending on the configuration explained in the above, the present invention can realize the following effects.

The optical displacement gauge can constantly measure the polishing quantity during the polishing process without interrupting the polishing operation.

Therefore, there is no need to perform the polishing operation repeatedly, which adopts a polishing rate derived from experience, or to measure the thickness of the stamper after the polishing operation repeatedly. Consequently, the time needed for the polishing process can be significantly shortened.

Because the aforementioned measurement becomes unnecessary, damage to the stamper caused during washing or measurement can be prevented.

In addition, the accuracy of the finished thickness of the stamper can be improved because the aforementioned indefinite polishing rate can be avoided, and the optical displacement gauge with a high measurement resolution is used. Consequently, the stamper defects caused by excessive polishing can be prevented.

Brief explanation of the figures

Figure 1 is a cloth-sectional view illustrating the main parts in a first application example of the present invention. Figure 2 is a block diagram for explaining the configuration in the first and second application examples of the present invention. Figure 3 is a cloth-sectional view illustrating the main parts in the second application example of the present invention.

1, 21	Stampers
1a, 21a	Die-installation surfaces
2, 22	Protective disks
3	Optical displacement gauge
3a	Sensor
3b	Computing element
3c	Cord

4	Glass plate
5	Polishing cloth
6	Polishing surface plate
6b	Installation hole
7	Polishing holder
8	Control unit
9	Driving part

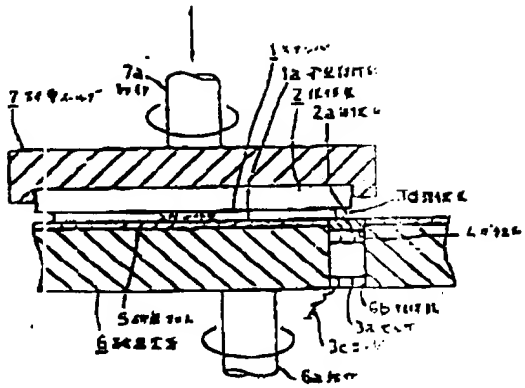

Figure 1

Key:	1	Stamper
	1a	Die-installation surface
	2	Protective disk
	2a	Measuring plane
	3a	Sensor
	3c	Cord
	3d	Measuring light
	4	Glass plate
	5	Polishing cloth

6 Polishing surface plate
6a Shaft
6b Installation hole
7 Polishing holder
7a Shaft

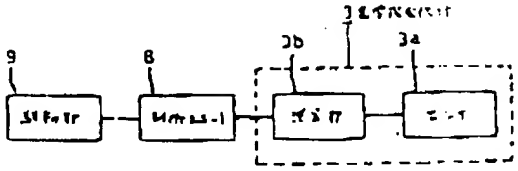

Figure 2

Key: 3 Optical displacement gauge
3a Sensor
3b Computing element
8 Control unit
9 Driving part

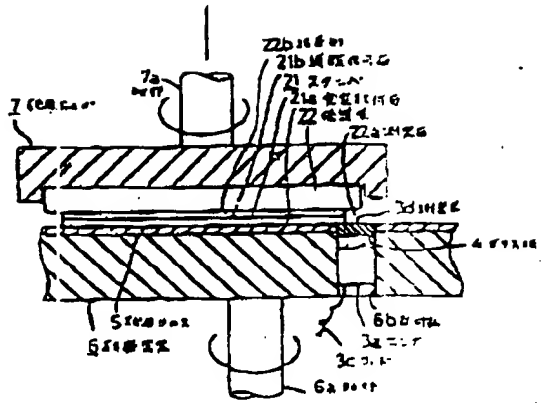

Figure 3

Key:
- 3a Sensor
- 3c Cord
- 3d Measuring light
- 4 Glass plate
- 5 Polishing cloth
- 6 Polishing surface plate
- 6a Shaft
- 6b Installation hole
- 7 Polishing holder
- 7a Shaft
- 21 Stamper
- 21a Die-installation surface
- 21b Information-signal surface
- 22 Protective disk
- 22a Measuring plane
- 22b Adhesive